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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/790,190  | 03/02/2004  | Katsuya Oda          | 520.43558X00        | 3957             |
| 20457   | 7590        | 05/27/2005           | EXAMINER            |                  |
| ANTONELLI, TERRY, STOUT & KRAUS, LLP<br>1300 NORTH SEVENTEENTH STREET<br>SUITE 1800<br>ARLINGTON, VA 22209-3873 |             |                      |                     | HO, TU TU V      |
| ART UNIT  |             | PAPER NUMBER         |                     |                  |
|   |             | 2818                 |                     |                  |

DATE MAILED: 05/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                      |                  |  |
|------------------------------|----------------------|------------------|--|
| <b>Office Action Summary</b> | Application No.      | Applicant(s)     |  |
|                              | 10/790,190           | ODA ET AL.       |  |
|                              | Examiner<br>Tu-Tu Ho | Art Unit<br>2818 |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

1) Responsive to communication(s) filed on 02 March 2004.  
 2a) This action is FINAL.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

4) Claim(s) 1-17 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) 1-6 and 10-17 is/are allowed.  
 6) Claim(s) 7 is/are rejected.  
 7) Claim(s) 8 and 9 is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on 02 March 2004 is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

|   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
|   | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### *Oath/Declaration*

1. The oath/declaration filed on 07/16/2004 is acceptable.

### *Drawings*

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the “an opening” of **claims 7 and 5** must be shown or the feature(s) canceled from the claim(s). No new matter should be entered. Note that each of claims 5 and 7 is directed to a semiconductor device having **an opening**, a first single crystal layer, a second single crystal layer, a source region, a drain region, a gate electrode, and a channel region, the channel region being formed in one or both of the first single crystal layer and the second single crystal layer, and the one or both of the single crystal layers being formed in the **opening**.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled “Replacement

Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

*Claim Objections*

3. **Claims 5 and 7** are objected to because of the following informalities:

As detailed above in the Drawing Objections Section, each of these claims recite a channel, the channel region being formed in one or both of the first single crystal layer and the second single crystal layer, and the one or both of the single crystal layers being formed in the **opening**. However, Figs. 13-15 and the corresponding description do not depict a physical opening. The only "opening" described by the specification for this aspect of the claimed invention is that of a virtual opening occupied and defined by and the physically tangible first and second single crystal layers. For examination purposes, the opening as claimed is treated as a virtual opening. Normally, an opening is treated as both a physical opening and a virtual opening, and for all practical purposes, a virtual opening is the same as a physical opening; however, in the instant case, the other aspect of the invention contains a real tangible physical opening (for example, opening 130 of Fig. 7A), and the examiner believes a distinction has to be established.

Appropriate correction is required.

4. **Claim 8** is objected to because of the following informalities:

Claim 8 recites: "a second single crystal layer" where the "a second single crystal layer" apparently is the second single crystal layer of claim 7 from which claim 8 depends. For examination purposes, "a second single crystal layer" is treated as "the second single crystal layer".

Appropriate correction is required.

***Claim Rejections - 35 USC § 102 or § 103***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in  
    (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or  
    (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. §103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**5. Claim 7 is rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Notsu et al. U.S. Patent Application Publication 20020146892 (the '892 reference).**

The '892 reference discloses in the figures, particularly Figs. 3A and 5C, and respective portions of the specification a semiconductor device, the device having the characteristics as claimed and as interpreted for the first and second single crystal layers in the embodiment of Fig.

3A and the characteristics as claimed and as interpreted for the gate/channel/source/drain device (a transistor as is known in the art) in the embodiment of Fig. 5C. The reference further teaches in paragraph [0188] that the embodiment of Fig. 5C is applicable to the embodiment of Fig. 3A.

Therefore, the limitations are either: (1) inherent if one of ordinary skill in the art subscribes to the interpretation that the embodiment of Fig. 5C is automatically structurally modifiable per the teachings of the embodiment of Fig 3A; or (2) obvious - if one yields to the argument that everything in a reference must be spelled out exactly word by word, element by element, to anticipate the claim - to one of ordinary skill in the art at the time the invention was made to modify the structure of Fig. 5C because of the teachings of the structure of Fig. 3A.

Specifically, the reference discloses a semiconductor device comprising:

an Si semiconductor substrate (1002, Fig. 5C, 11, Fig. 1A);

an insulating film (1054) having an opening (as interpreted above in the Drawing Objections Section and the Claims Objection Section) formed on (the) Si semiconductor substrate;

a layered structure (113/1106/1105, Figs. 3A and 5C, i.e., layered structure SiGe layer 1106/strained Si layer 1105 – paragraph [0189] - applied to the embodiment of single crystal layer 113/ SiGe layer 114/single crystal layer strained Si layer 115 – paragraphs [0143]-[0157]) including one or both of the first single crystal layer (113) formed in the opening and the second single crystal layer (1105) formed on the first single crystal layer;

a gate electrode (1055) formed on the second single crystal layer,

a channel region (no number) formed at a portion facing the gate electrode in one or both of the first single crystal layer and the second single crystal layer; and

a source region (1057/1058) and a drain region (1057/1058) interposing the gate electrode therebetween.

In the alternative, the reference discloses in Fig. 5C a semiconductor device substantially as claimed and as detailed above including a layered structure 1106/1105 including the single crystal strained Si 1105, which is the same as the claimed second single crystal layer, but fails to teach a first single crystal layer.

The reference, however, discloses in Fig. 3A and paragraphs [0143]-[0157], particularly paragraph [0143], that the addition of the first single crystal layer 113 helps forming a high-quality layer 114, which is layer 1106 of Fig. 5C.

Therefore, it would have been obvious to one of ordinary skill in the art the time the invention was made to form the reference's layered structure 1106/1105 so that it includes a first single crystal layer. One would have been motivated to make such a change because the addition of the first single crystal layer 113 helps forming a high-quality layer 1106, as taught by the embodiment of Fig. 3A.

#### *Allowable Subject Matter*

6. Claims 1-6 and 10-17, in so far as in compliance with the drawing objections, are allowable over the prior art of record.

Claims 8 and dependent-upon-claim-8 claim 9, in addition to the drawing objections and the claim objections detailed above, are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for the indication of allowable subject matter: The cited art, whether taken singularly or in combination, especially when all limitations are considered within the claimed specific combination, fails to teach or render obvious a semiconductor device and a method of forming thereof with all exclusive limitations as recited in claims 1, 2, 7/8, 11, 12, 13, and 14, comprising an Si semiconductor substrate; an insulating film having an opening formed in the Si semiconductor substrate; a first single crystal layer disposed in the opening; and a second single crystal layer formed on the first single crystal layer; wherein the first single crystal layer and the second single crystal layer each comprises a single crystal (SiGe)C layer having one or both of Si and Ge, and a stoichiometric ratio of the sum of Si and Ge to C being about 1:1, and wherein either: a forbidden band width of the first single crystal layer is different from that of the second single crystal layer, or: a gate, a source, a drain, and a channel as claimed.

### *Conclusion*

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tu-Tu Ho whose telephone number is (571) 272-1778. The examiner can normally be reached on 6:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, DAVID NELMS can be reached on (571) 272-1787. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

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may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*RH*  
Tu-Tu Ho  
May 25, 2005